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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/516,579
Filing Date: April 21, 2005
Appellant(s): KLOOS ET AL.

Andrew Peret
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 7/30/09 appealing from the Office action mailed 12/31/08.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is deficient. 37 CFR 41.37(c)(1)(v) requires the summary of claimed subject matter to include: (1) a concise explanation of the subject matter defined in each of the independent claims involved in the appeal, referring to the specification by page and line number, and to the drawing, if any, by reference characters and (2) for each independent claim involved in the appeal and for each dependent claim argued separately, every means plus function and step plus function as permitted by 35 U.S.C. 112, sixth paragraph, must be identified and the structure, material, or acts described in the specification as corresponding to each claimed function must be set forth with reference to the

specification by page and line number, and to the drawing, if any, by reference characters. The brief is deficient because of the following:

Summary of the claimed subject matter for claim 74 is correct.

For claim 89, there is no support for the void volume of at least 50%.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6190556	ULINGER	02-2001
4802982	LIEN	02-1989

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 112

A. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 89-92 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter

which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 89-92 recite void volumes of 50, 60,70 and 80%, which does not appear to be having support in the original specification or claims.

B. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 74-92 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims recite *interalia* H-values and void volumes of a permeate carrier without reciting any specific structure and membrane having a capability to reject MgSO4 to >50%. Of these, the MgSO4 rejection is a membrane characteristic independent of the H-value or the void volume of the permeate carrier. The specification discloses H-value as a product side pressure drop parameter, and depends on the friction factor, fluid viscosity and the hydraulic diameter of the channel.

$$H = \frac{f_t 4\mu}{d_h^3}$$

Thus H is dependant on the process fluid characteristics and certain dimensions of the material, and there can be several different permeate carrier materials having different combinations of dimensions and process fluids that would meet the same H-value and

void volumes, which would make this claim indefinite, because one of ordinary skill in the art would not be able to identify the metes and bounds of the claims.

Claim Rejections - 35 USC § 103

Claims 74-92 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Uhlinger (US 6,190,556) and Lien (US 4,802,982).

Claim interpretation: The claims are limited to a [spiral wound] membrane device having one or more first and second membrane sheets separated by a permeate carrier, the permeate carrier having certain "H" value [and void volume]. The membrane has certain "A" value. Claims also recite permeate carrier thickness, and the characteristics of the membrane such as $MgSO_4$ rejection, lengths and widths of the membrane leaves, etc.

The parameters H and A are defined by Lien. Lien also teaches how to optimize these factors for improving the performance of the spiral wound membrane elements. Discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art. In re Boesch and Slaney, 205 USPQ 215 (CCPA 1980); In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977); "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Definitions of H and A (page 6 of applicant's specification):

A is the membrane permeability, which is a membrane characteristic.

H is defined as a product side pressure drop parameter, and depends on the friction factor, fluid viscosity and the hydraulic diameter of the channel. Of these, at least the fluid viscosity is operating fluid-dependent and unrelated to the device claimed. Friction factor is a combination of material and flow characteristics. Thus what is accomplished by these equations is a method of optimizing the membrane cartridge design for certain operations conditions. From the definition of H, it is very clear that many different designs of permeate spacer material could have the same/similar range of values for H. Thus reciting values for these parameters in the claim would not make them patentable without specific structure and also a showing of secondary evidence for patentability. Lien also teaches a permeate carrier having an H-value of 0.045 and less – see table 2.

Uhlinger'556 teaches membrane devices capable of salt rejection >50% (col 8 lines 1-37: discusses monovalent and divalent salts). Even though $MgSO_4$ is not specifically taught, it would be obvious to one of ordinary skill in the art that $MgSO_4$ will have similar rejections. Uhlinger'556 teaches the membrane permeability (A value) for reverse osmosis and nanofiltration membranes as ranging from 10 to over 60 (see the typical flux data in column 2, lines 1-10 and column 8, lines 15-37 for commercial membranes). Uhlinger'556 does not teach the H and β values, thickness of permeate carrier or leaf length. Lien'982 teaches all these parameters and how to optimize the design based on these parameters (see columns 7-9, tables and working examples). It would be obvious to one of ordinary skill in the art at the time of invention to use the teachings of Lien'982 in the teaching of Uhlinger'556 to optimize the membrane device

design for the desired performance. Even though none of these references teach specifics of leaf length and the number of leaves, leaf length and the number of leaves are variables that one of ordinary skill is capable of optimizing to provide the required membrane area for the desired permeate (product water) flow. The cross flow velocity of the feed is a process parameter, which has no structural relationship with the device claimed, and one of ordinary skill in the art is also capable of optimizing flow velocity from the feed quality, and the device specifics to minimize the pressure drop.

Regarding the specific dimensions of membrane elements, such as diameter 3.25" or less and 3-5 feet length: such elements are commercially available and commonly used in home-RO units. Even otherwise, they are not patentable. In Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), the Federal Circuit held that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966) (The court held that the configuration of the claimed disposable plastic nursing container was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed container was significant.).

Defining a permeate carrier as a feed carrier as in claim 1 would not further limit the claim because it does not structurally limit the claim further. Void volumes of the

carrier materials are inherently in the range claimed: see the description of the Conwed or Nalle materials in column 6, line 15 – column 7, line 6 of Lien, which also are similar to the typical feed spacer used in the spiral wound construction of the membrane cartridges.

(10) Response to Argument

I. Rejection of claims 89-92 under 35 USC 112, first paragraph, written description:

The applicable law under 35 USC 112, first paragraph, enablement, cited against the argument is in error: the rejection is for new matter, not enablement.

In the actual arguments, appellant cites various portions of the specification, none of which provide any disclosure in support of the limitation in claim 89, "the permeate carrier having a void volume greater than 50 percent". Page 12, line 17 – page 13, line 10, cited in the summary of claimed subject matter as well as in the argument, does not provide such support. Support is lacking for the greater than 60%, greater than 70% and greater than 80% in the dependent claims 90-92 as well.

While it is possible that the cited materials for the spacers may have void volumes falling within the range claimed, it is not possible for the examiner to determine if they, in fact, have the stated void volume, and they would not support the ranges as claimed.

New or amended claims which introduce elements or limitations which are not supported by the as-filed disclosure violate the written description requirement. See, e.g., In re Lukach, 442 F.2d 967, 169 USPQ 795 (CCPA 1971) (subgenus range was not supported by generic disclosure and specific example within the subgenus range); In re Smith, 458 F.2d 1389, 1395, 173 USPQ 679, 683 (CCPA 1972) (a subgenus is not necessarily described by a genus encompassing it and a species upon which it reads). [MPEP 2163, I, B]

II. Rejection of claims 74-92 under 35 USC 112, second paragraph as indefinite:

MPEP 2173.05: A claim may be rendered indefinite by reference to an object that is variable. For example, the Board has held that a limitation in a claim to a bicycle that recited "said front and rear wheels so spaced as to give a wheelbase that is between 58 percent and 75 percent of the height of the rider that the bicycle was designed for" was indefinite because the relationship of parts was not based on any known standard for sizing a bicycle to a rider, but on a rider of unspecified build. Ex parte Brummer, 12 USPQ2d 1653 (Bd. Pat. App. & Inter. 1989).

MPEP 2173.05: Open-ended numerical ranges are indefinite.

In the instant case, "the permeate carrier having an H-value of about 0.045 or less" is indefinite for several reasons:

(1) the term H is defined as:

$$H = \frac{f_l 4 \mu}{d_h^3},$$

[0029] where f_l is a friction factor

[0030] μ is the viscosity

[0031] d_h is the hydraulic diameter of the permeate channel

Friction factor depends on the flow characteristics of the fluid and surface characteristics of the spacer and membrane materials the fluid comes in contact with in the permeate channel of the membrane module. Viscosity of a characteristic of the fluid, and the hydraulic diameter is a fluid channel property, not a spacer material property. The Examiner respectfully submits that there can be many possible materials that would have the H value for the combination of fluids, membranes and the spiral wound design of the module that would fall within the range of “0.045 or less” as claimed, and thus one of skill in the art would not able to determine the metes and bounds of the claimed limitation. Appellant’s disclosure, paragraphs 0034-0036 of the application publication provide further evidence for this indefinitness. Comparison between the tables in pages 5 and 6 show for the same spacer material, Delstar S111, the H value of 0.05 in the table of page 5, where as it is 0.03 in the table of page 6. (see the application publication)

Reasonable and customary definition of hydraulic diameter in fluid mechanics is = 4 x flow area /(wetted perimeter). Flow area = leaf length of membrane wrap x permeate channel thickness x permeate spacer void fraction. Wetted perimeter is the twice the (length of leaf + permeate channel thickness). This factor has membrane leaf length as a variable in it.

Thus the same material can have a different value of H, depending on the spiral design, the fluid characteristics and the membrane used, and different materials can have the same H value.

The prior art Lien defines the H factor as product (permeate) side pressure loss coefficient with units second-atm/gm. (same as appellant's) (column 8, lines 15-20, and column 9, lines 57-58), and which can be empirically determined for different membranes and carrier configurations. (column 10, starting at line 4). Thus it is not a characteristic of the spacer material, but a process design parameter.

Spiral wound membrane art is a very crowded art, and there are many different designs commercially available, and many of them may actually read on this claim limitation. Thus this factor H, while very useful as a design tool, is indefinite for defining a specific product or range of products.

(2) the range "0.045 or less" includes zero as a value for the H-value, which is also indefinite.

35 USC 103(a) rejection of claims 74-92 over the combination of Lien and Uhlinger:

The Lien Reference:

First of all, the argument that Lien teaches only ultrafiltration membranes is factually wrong. Lien teaches clearly that the membrane cartridge construction is for both ultrafiltration and reverse osmosis (abstract and at several places in the specification). Lien teaches in column 17 at line 62:

"For example, thin film composite membranes, and especially microporous, semipermeable ultrafiltration and reverse-osmosis membranes, such as polysulfone membranes, which are cast

separately and then laminated onto a carrier layer of the type described in FIG. 5, yield significantly improved cartridge efficiencies." [underline by Examiner]

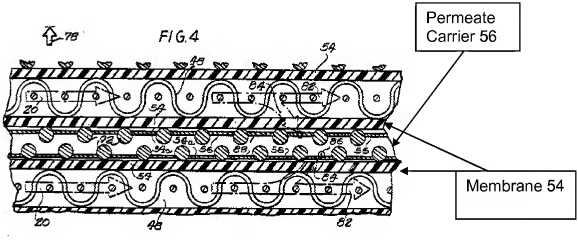

Fig. 4 of Lien showing the internal structure of membrane layers: two layers of the membrane 54 separated by the permeate carrier layer 56.

It is agreed that Lien does not explicitly teach of a permeate carrier of H value of about 0.045 atm--cc/gm or less in combination with a membrane device capable of at least 50% $MgSO_4$ rejection, etc. What Lien teaches is optimizing the permeate channel design to improve the membrane module efficiency. Lien also teaches permeate carrier materials, such as disclosed by the Appellant, which affords the H values within the range to the permeate channels as claimed in Table 2 of Lien, copied below:

TABLE 2

EXAMPLE	MEMBRANE	BACKING	TRICOT	H-VALUE
1	Gore-Tex .2	Conwed, 25 wales	None	.0525
2	Gore-Tex .2	Conwed, 20 wales	None	.0295
3	Gore-Tex .2	Nalle, 56 wales	None	.0450
4	Polysulfone E-500	Polyester felt K-1015	Hornwood	.351

[Note: Further support for the indefiniteness of the claims: the H value defined herein is "for the arrangement", and not for the carrier material – see column 11, lines 4-6]

Thus Lien teaches how to optimize the permeate channel design using H value to improve efficiency. Lien also teaches that this technique can be used for improving efficiencies of ultrafiltration and reverse osmosis membranes, and particularly of using the thin film composite membranes.

What Lien does not teach in the reference is only a membrane that can reject MgSO4 at the specified conditions that is used in combination with the specific design of permeate channels. However, this would be obvious to one of ordinary skill in the art because nanofiltration and reverse osmosis membranes that reject MgSO4 to greater than 50% at the conditions specified are well known in the art and commercially available, and one would make optimal designs based on available technologies, such as what is taught by Lien, to obtain modules of improved performances.

IN addition, the 65 psi applied pressure, 10 cm/s velocity, 77F temperature, 500 ppm MgSO4, etc are only operational parameters, which do not constitute patentable limitations to the device claims. They are also recited as only conditions at which the membrane is supposed to reject MgSO4 to greater than 50%. The feed side velocity is to prevent the feed side concentration polarization on the membrane, and has nothing to do with the permeate side pressure drop. Feed side pressure must be sufficient to overcome the osmotic pressure of the solution, so that the solvent moves across the membrane. The temperature recited is standard ambient. All these parameters do not contribute to the permeate side channel design. It is given that reducing the permeate side back-pressure would improve the module performance by increasing the trans-membrane pressure available to overcome the osmotic pressure and drive the liquids

across the membrane. That is the only contribution the pressure of 65 psi has in this argument. Lien teaches how to reduce this permeate side back-pressure by properly choosing the permeate channel H value for the module design.

Also, the reverse osmosis membranes as taught by Lien inherently reject MgSO4 to greater than 50% at the conditions recited. Appellant has not provided any evidence to the contrary.

The Examiner also submits that the void volumes of the Conwed and Nalle materials recited in Table 2 above are greater than 50%, or even 80% - same or similar material as used by the Appellant. Appellant has not provided any evidence to the contrary.

The limitation in claim 74, "a feed carrier that is used as a permeate carrier" does not limit the claims any further because it does not further define any particular structure [This limitation also is indefinite because it is unclear what appellant is trying to limit: feed carrier or permeate carrier? However, based on appellant's disclosure, it is assumed that the permeate carrier used in Appellant's claim 74 is normally used as a feed carrier in the RO industry]. Even though the Lien reference does not explicitly state that a feed carrier material could be used as a permeate carrier material, both the Conwed and the Nalle (now DelStar) materials listed in Table 2 are feed carrier materials. Appellant has not disputed this fact.

The Uhlinger Reference:

The Uhlinger reference teaches both nanofiltration and reverse-osmosis membranes that reject MgSO4 to greater than 50%. These are commercially available membranes. It is agreed that Uhlinger does not explicitly teach rejection of MgSO4 at 65 psi pressure and 10 cm/sec average feed channel cross-flow velocity at 77F. However, the membrane used is commercially available membranes which inherently reject MgSO4 at these conditions. Applicant has not provided any evidence to the contrary. In fact applicant describes similar commercially available membranes in the specification as is used by Uhlinger. Uhlinger also teaches A values as shown in the rejection.

The rejection has *prima facie* shown that Lien alone would make the claims obvious. In addition, it would be obvious to one of ordinary skill in the art to use the specific membranes taught by Uhlinger in the teaching of Lien to design modules as taught by Lien to make high efficiency NF and RO membranes. Alternately, one of ordinary skill in the art would make the NF and RO membranes of Uhlinger more efficient by using the design and optimization principles of Lien. Thus there is a strong prima facie case of obviousness against patentability of Appellant's claims.

Regarding the A value taught by Uhlinger, first of all, it is not material to this appeal, since A value is not a limitation claims 74 and 89. Secondly, claim 79 recites A value as less than 15, not greater than 25. Thirdly, by applicant's own calculation, A value = GFD*69.3/psi = (25*69.3/70) to (40*69.3/100) = about 25-28. See Uhlinger,

column 8, lines 16-37: NF membranes when operated at pressure range 70-100 psig while producing a flux of 25-40 GFD.

Void volumes of the spacer material are inherently as claimed; appellant has not provided any evidence to the contrary. Particularly, the void volume of the Nalle (now, DelStar) and Conwed materials as taught by Lien in Table 2 would be greater than 50%. And the Examiner submits that Lien does in fact inherently anticipates the claims, or all the limitations of claim 74 and 89 are implied in the teachings of Lien. Appellant's specification discloses the teachings of the Lien reference with some newly added optimized data points and do not describe any new invention.

Argument that *claims recite an RO membrane that has very low H value, which have never existed before*: this argument is further evidence of the confusion Appellant creates about the "H-value". Claims recite H-value for the permeate carrier.

Argument of "long felt need" has no supporting evidence.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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